Fall 2012

CS 7900-01: Multimedia Networking

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CS 7900-01 – Multimedia Networking
3 Credits, Fall Semester 2012
Syllabus

Time/Place: Lecture: 6:10 – 7:30 PM, M/W, Joshi 193

Instructor: Dr. Yong Pei, 489 Joshi Research Center
Tel. 937-775-5111, Email: yong.pei@wright.edu
Office Hours: 3:30-4:30 pm, M/W.

Prerequisites: CEG 6400 (or equivalent)

Recommended Textbook:
Khalid Sayood, Introduction to Data Compression, 3rd Edition, Morgan Kaufmann Publishers, 2005

Supplemental Readings:
- Recent journal and conference papers and standards on Multimedia coding, networking and applications.
- Lecture slides will be posted through Pilot.

Catalog Description:

This course provides an in-depth examination of the fundamental concepts, principles, design guideline and protocols in multimedia coding and networking. Topics include: fundamentals of QoS networking techniques, lossless and lossy multimedia coding technical evolutions, the state-of-the-art data coding techniques and industry standards such as JPEG/JPEG2000, SPIHT, H.261/H.263/H.264, Motion JPEG2000, and MPEG2/MPEG4, MPEG21, and Multimedia over Internet applications and Mobile Multimedia services.

Course Objectives:
This Course is designed to introduce students to:

1. QoS mechanisms, protocols and architectures (scheduling, shaping, RTP, Int-serv, Diff-serv, RTP, RSVP),
2. Congestion control techniques (TCP, Frame-relay)
3. Traffic engineering (IP-over-ATM, MPLS, OSPF-extensions, VPNs)
4. Measuring and Instrumenting the Internet
5. Coding techniques for multimedia networking:
    a. lossless compression, such as Huffman coding, arithmetic coding, predictive coding and dictionary techniques.
    b. lossy compression, such as quantization, differential coding, Speech, Audio, image and video Compression and etc.
    c. Motion estimation techniques and Motion compensated compressions.
    d. Transform coding, subband coding and wavelets.
6. The state-of-the-art data coding techniques and industry standards, such as JPEG/JPEG2000, SPIHT.
7. The state-of-the-art Image/Video coding techniques and industry standards, such as H.261/H.263/H.264, Motion JPEG2000, and MPEG2/MPEG4, MPEG21.

8. Multimedia applications over Internet: Voice over IP (VoIP), and Video on Demand (VoD), interactive videos.
9. Error-resilient coding techniques for sensor networks.
10. Distributed Signal Processing and Source Coding.
11. The evolution of data compression techniques and its impact on the economy and every-day life.
12. Computer tools and WWW resources, such as AVC, OpenH323.

Website: CS 7900 in Pilot.

Grading:
Project – 30 %
Homework – 10%
Midterm Exam – 30%
Final – 30%

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Lectures:

The following tentative schedule defines in greater details what material is covered in the course and when it is covered. Specifically, we will start with a review of basic networking ideas and then review and study topics such as:

- Congestion control techniques (TCP, Frame-relay)
- QoS mechanisms, protocols and architectures (scheduling, shaping, RTP, Int-serv, Diff-serv, RTP, RSVP),
- Lossless Compression Techniques:
    - Entropy, Conditional Entropy, Source Coding Theorems
    - Huffman coding, arithmetic coding, predictive coding and dictionary techniques
- Lossy Compression Techniques:
    - Rate-Distortion Theory and Quantization
    - Introduction to Speech/Audio/Image/Video Compression
    - Transform coding
    - JPEG/JPEG2000
    - H.261/H.263 / MPEG2/MPEG4/H.264
- Error-resilient coding techniques for sensor networks
    - Intra-Updating, Error Concealment
    - Joint Source-Channel (Network) Coding
    - Slepian-Wolf / Wyner-Ziv Coding
    - Distributed image/video coding
    - Practical Distributed Source Coding techniques
- Multimedia over Internet:
    - Voice over IP (VoIP), H.323 and SIP, Video on Demand (VoD)
    - Interactive videos
    - Mobile multimedia: cross-layer design challenges and benefits